A FIRST STUDY OF THE RELATION BETWEEN
PERCENTAGE OF ILLITERACY AND DEATH
RATE IN AMERICAN CITIES.

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May 11, 1923.

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The problem

The effort was made in this study to secure from as large an experience as possible, taking into consideration the time available to work on the problem, figures on percent of illiteracy, to correlate these figures with death rates from various diseases, and as many other variables as my time would permit, and, by the method of partial or net correlation, to hold these variables constant and thus more accurately determine the effect of illiteracy on the death rates.

Illiteracy and ignorance must not be taken as synonymous. Schooling helps experience and worldly wisdom but never wholly replaces it but the ability to read and write is fundamental and lack of this is such a handicap that illiteracy implies ignorance. Some ignorant persons may be illiterate but most Illiterates are ignorant. Intelligence, however, implies mental ability but untrained, its usefulness is restricted, and such a condition is true of an illiterate.

Five and a half million people in this country over ten years of age are illiterate or nearly
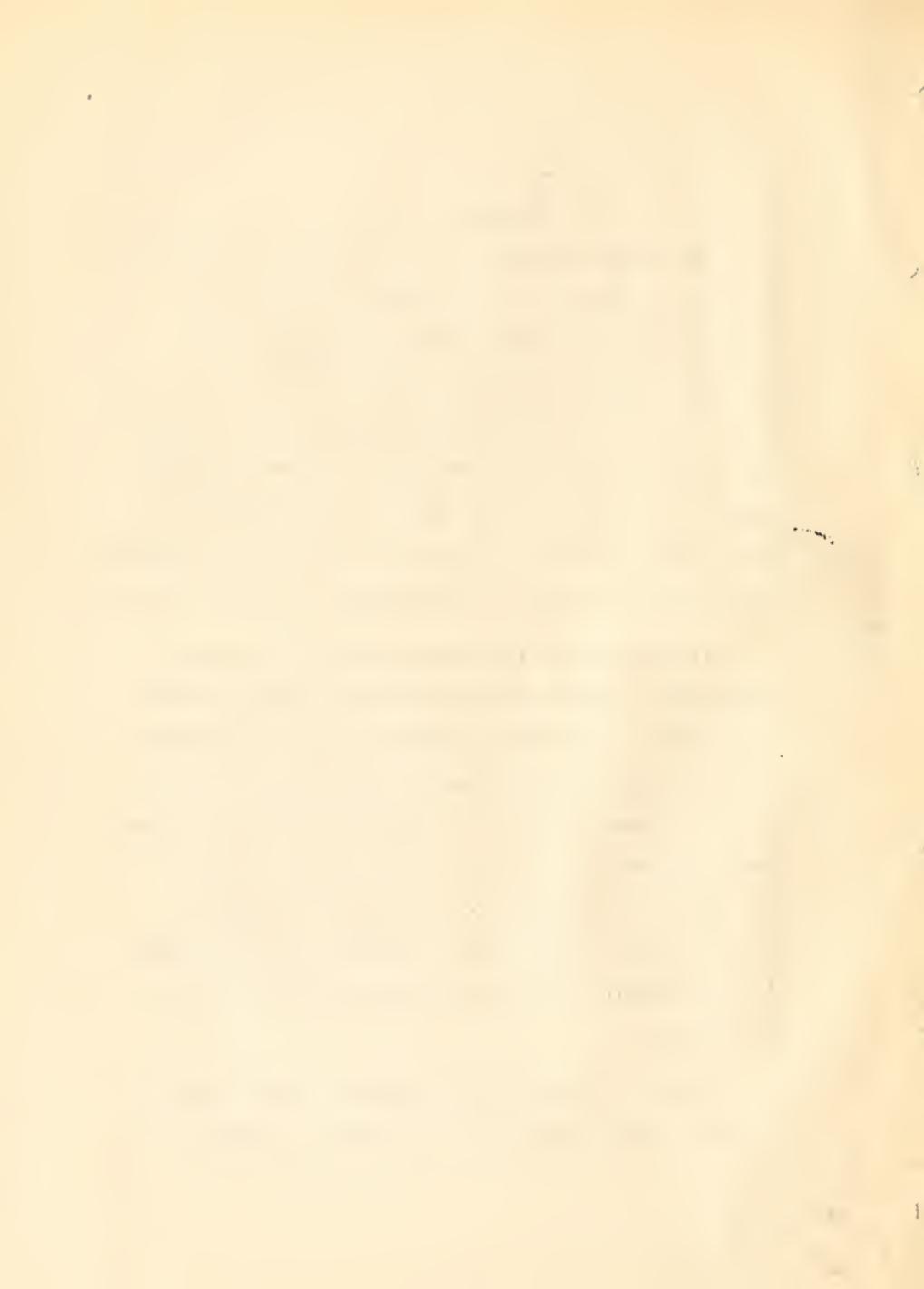
eight out of every hundred (1910). Of these, over
a million can speak no English. The census divides
these into four classes: native white (1,534,272),
foreign born (1,650,361), negro(2,227,731), others
(103,859). Every class of illiterates has decreased
excepting the foreign born which, during the last
thirty five years, has overbalanced the decrease of
the other classes. The negro illiterates have
decreased from 3, 150,000 in 1880 to 2,227,731 in
1910, native born white illiterates have decreased
from 2,255,460 to 1,534,272 and since 1890, there
has been a decrease of illiteracy among native born
of native parents from 1,890,723 to 1,378,884, while
among native born of foreign or mixed parentage from
174,280 to 155,388.

Percentage of illiteracy among native whites, the foreign born, and negroes at certain periods.				
	1880	1890	1900	1910
Native white				
percent of total population	73.5	73.0	74.5	74.4
percent of illiteracy	9.4	6.2	4.6	3.0
Foreign born				
percent of total population	13.1	14.5	13.4	14.5
percent of illiteracy	12.0	13.5	12.9	12.7
Negroes				
percent of total population	13.1	11.9	11.6	10.7
percent of illiteracy	68.0	57.1	44.5	30.4

The number of illiterates is steadily increasing--
not in the South--but in Massachusetts, Rhode Island,
Connecticut, New York, New Jersey, Pennsylvania,
Illinois, North Dakota, Nebraska, Montana, Wyoming,
Colorado, New Mexico, Arizona, Utah, Nevada, Washington,
California. The greatest increase being in the New
England and Middle Atlantic States, there having
been an increase of approximately 140% in twenty years
in these states while on the other hand there is a
decrease of thirty percent in the same period in the
South Atlantic States.

The percent of illiteracy in the United States
has been lowered during twenty years from 13.3% in
1890 to 10.7 in 1900 and 7.7% in 1910; but the number
of illiterates has decreased less than 15% and the
number of foreign born illiterates has increased 43%.

Prior to 1900, changes in illiteracy were less
striking due to a more literate type of immigrant who
came mainly from Canada, England, and countries in
northwestern Europe

More than two thirds of all illiterates are
country dwellers (3,748,031) of whom 1,342,372 are
native whites, 477,870 foreign born, 1,834,458 negroes.

While the illiterates in cities are divided thus:
191,900 native whites, 1,172,491 foreign born,
393,273 negroes. Therefore the rural problem lies
with the negroes and native whites and the urban
with the foreign born. Foreign born illiterates are
mainly in towns and cities of the New England States
(232,030), Middle Atlantic States (582,756), East
North Central States (217,771); native white illiterates
mainly in rural communities of the South Atlantic
States (400,507), East South Central States (362,178),
West South Central States (217,719); and negroes who
are illiterate mainly in rural communities of the
South Atlantic States (810,526), East South Central
States (581,250), West South Central States (411,370).

Half the illiterate population (48.1%) are
between 20 and 45 years of age.

Age	Number	Percent	White	Negro
10-14	370,136	6.7	1.8	18.9
15-19	448,414	9.0	2.8	20.3
20-24	622,073	11.2	4.6	23.9
25-34	1102,384	19.9	5.2	24.4
35-44	940,510	17.0	5.4	27.7
45-54	829,153	15.0	)	52.7
55-64	607,754	11.0	) 6.7	
65 +	573,799	10.4	9.4	74.5

There are 2,814,950 illiterate males to 2,701,213
illiterate females. However the percent of illiteracy

among females (7.8) is slightly greater than among
males (7.6) due to the larger percent of illiteracy
among foreign born women and negro women.

Percent of illiteracy by states			
Iowa	1.7	New York	5.5
Nebraska	1.9	New Jersey	5.6
Oregon	1.9	Oklahoma	5.6
Washington	2.0	Pennsylvania	5.9
Idaho	2.2	Connecticut	6.0
Kansas	2.2	Nevada	6.7
Utah	2.5	Maryland	7.2
South Dakota	2.9	Rhode Island	7.7
Minnesota	3.0	Delaware	8.1
Indiana	3.1	West Virginia	8.3
North Dakota	3.1	Texas	9.9
Michigan	3.2	Kentucky	12.1
Ohio	3.2	Arkansas	12.6
Wisconsin	3.2	Tennessee	13.6
Wyoming	3.3	Florida	13.8
California	3.7	Virginia	15.2
Colorado	3.7	North Carolina	18.5
Illinois	3.7	New Mexico	20.2
Vermont	3.7	Georgia	20.7
Maine	4.1	Arizona	20.9
Missouri	4.3	Mississippi	22.4
New Hampshire	4.6	Alabama	22.9
Montana	4.8	South Carolina	25.7
Dist of Col	4.9	Louisiana	29.0
Massachusetts	5.2		

The United States census figures for 1910 were
used to determine the percent of illiterates over ten
years of age, the population, the percent of negroes;
and figures from the Mortality Statistics of the
United States registration area 1910 were used to
determine the death rates. It was hoped to include
the rural counties in the problem as well as the
cities over 10,000 but it was found impossible because
the rural counties in the census figures included
cities over 10,000 and the rural counties in the
mortality statistics did not include these cities.
In addition, the percentage of illiterates and
negroes would have had to be calculated for all of
which time was lacking. Therefore the experience is
limited to four hundred and sixty one cities of the
United States of over 10,000 population, of which one
of these, South Sharon, Pennsylvania was omitted. This
city had a population of but 10,190 yet had an illiteracy
percent of 52.4, negroes 1.8, foreign born 59.1; but
the death rates did not at all correspond having in
most instances wide variation in the above percentages.
New York City was divided into its boroughs in order
to study the city in as small units as possible.

The several factors correlated were: (1) population,
(2) illiterates, (3) negroes with death rates (a) from
all causes, (b) from typhoid, (c) from measles, (d) from
whooping cough, (e) diphtheria, (f) tuberculosis of
the lungs, (g) cancer, (h) pneumonia, (i) diarrhoea under
two years of age, (j) nephritis, (k) puerperal fever,
(l) suicide and, to aid in computing the partial
correlation coefficients, population was correlated
with illiterates and negroes and illiterates were
correlated with negroes.

Percentage of foreign born was to be included
in the tables but the differences in age distribution
of the population in the various cities seemed too
great a variable to overlook in this case and so was
reserved for further work.

Thirty nine correlation tables were set up
between the various factors and their correlation
coefficients were determined. Using these thirty
nine correlation coefficients, a series of partial
correlation coefficients were obtained according to
the regular formulae. No attempts were made to
correct the tables for spurious correlation (it being
decided that it played but little part in affecting
the significant correlations). The material was not

corrected for age distribution, for sex, for density
of population which I hope to accomplish at a later
date.

The Census Report 1910 Volume I page 1185 gives
the definition upon which its figures of illiteracy
are based: "The population schedule for the census
of 1910, like those for several previous censuses,
contained two inquiries relating to illiteracy,
namely, as to whether the person enumerated was able
to read and as to whether he was able to write. Under
the instructions to enumerators, ability to read or
write in any language--not necessarily English, called
for an affirmative answer. Answers to these questions
were required only for persons ten years of age and over.

"For the present report, the Bureau of the Census
has classified as illiterate all persons unable to
write regardless of ability to read. A limited
number of persons were reported as able to read
though not able to write but the statistics in regard
to this class have not seemed of sufficient importance
to call for a separate presentation. ,,,,,,,, In general,
the "literate" population in this report should be
understood as including all persons who have had even
the slightest amount of schooling while the illiterates
represent persons who have had no schooling whatsoever."

The term "significance" in this paper is limited
to a restricted meaning. When the correlation coefficient
in question is four times its probable error, the
coefficient is termed significant. e. g. .135 ± .030,
where .135 = correlation coefficient and .030 =
probable error, is significant since .030 x 4 is less
than .135. Similarly .104 ± .031 is not significant
since .031 x 4 is greater than .104;

Results

Summary of correlation coefficients - given death rate from all causes and several factors	
Net correlation coefficient $R_{12.34}$	$.333 \pm .028$
Net correlation coefficient $R_{14.23}$	$.359 \pm .027$
Net correlation coefficient $R_{13.24}$	$.016 \pm .031$
Percent of illiteracy	$.436 \pm .025$
Population	$.037 \pm .031$
Percent of negroes	$.455 \pm .025$

(In each of the following tables the subscripts
attached to the net correlation coefficients
have the following meanings: 1 = death rate
from the disease in question; 2 = percent of
illiteracy; 3 = population; 4 = percent of
negroes.)

As is seen above, there is rather high correlation
(1) between percentage of illiteracy and deaths from
all causes and (2) between percentage of negroes and
deaths from all causes. Both (1) and (2) are lowered
slightly when the two remaining factors are held
constant but still the sensible correlation remains
and the facts are that illiteracy and negroes both
affect the death rate by raising it. Naturally, this
is a composite picture of the several death rates and
it will be interesting to follow through the different
tables and see whether this relation (of both illiteracy
and negroes affecting the death rate) holds throughout.
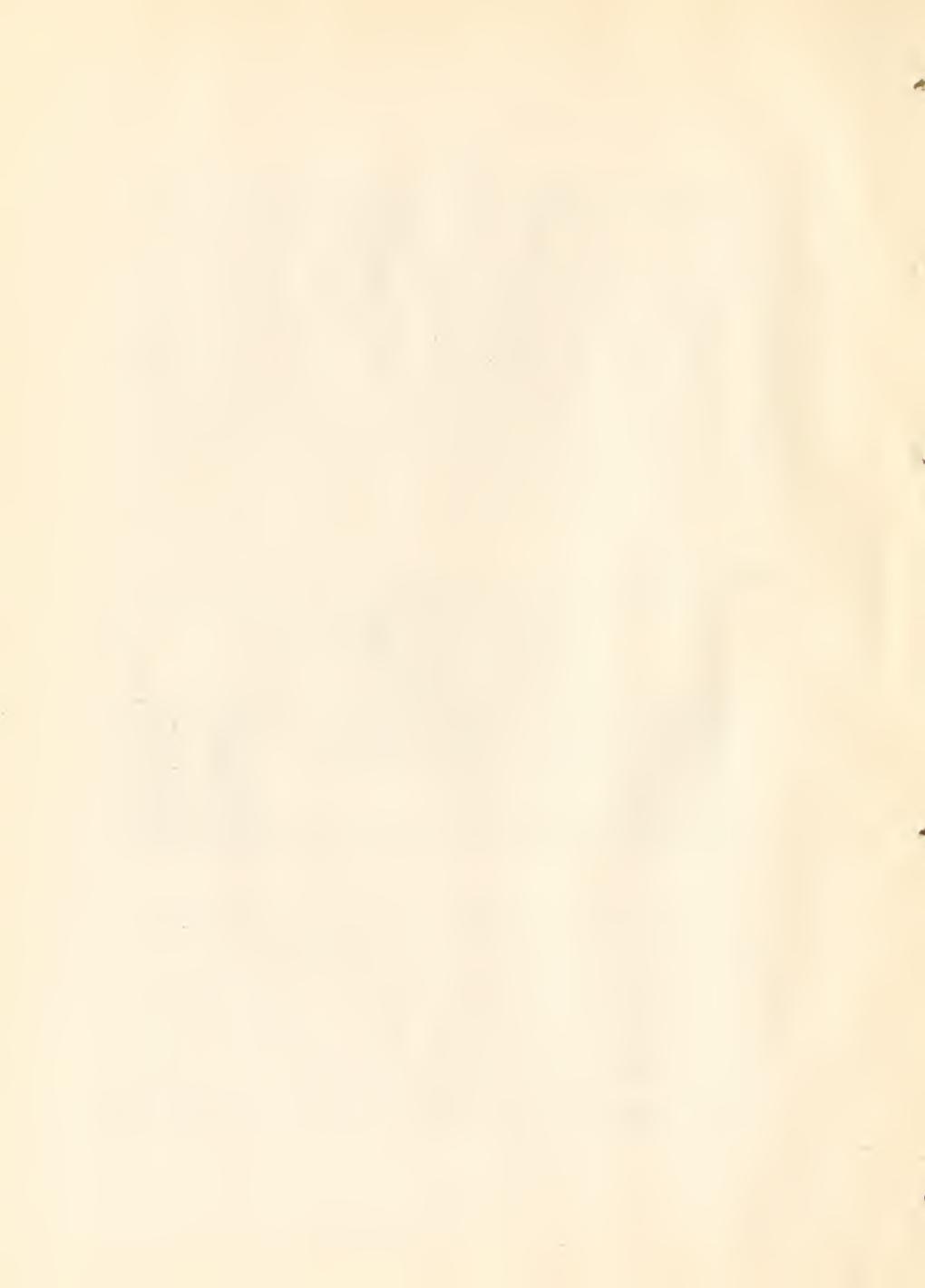It is clearly evident that both are very serious factors

in raising the death rate. On the other hand, the size of the city has no significant effect on the total death rate which is very evident in the net correlation coefficient $R_{13.24}$. One might conclude from this that overcrowding alone does not appreciably raise the death rate--though to truly arrive at this conclusion, the density of population should be taken into consideration.

Typhoid Fever

Summary of correlation coefficients between death rates from typhoid fever and several factors.	
Net correlation coefficient $R_{12.34}$	-.046 ± .031
Net correlation coefficient $P_{14.23}$	.180 ± .030
Net correlation coefficient $R_{13.24}$	-.085 ± .031
Percent of illiteracy	.016 ± .031
Population	-.075 ± .031
Percent of negroes	.171 ± .031

Typhoid fever appears not to be significantly affected by illiteracy in the city populations. It would be interesting to correlate the rural population for this purpose for it is known that typhoid is more truly an individual personal illness. While in the city, it is a community and almost a state wide responsibility.

But there is positive significant correlation between percentage of negroes and the disease. It is popularly believed that negroes are not as liable to the disease as the white race but once contracted, the disease is more fatal. The increased fatality over the white race is clearly shown by the correlation coefficient $R_{14.25}$ .180. Size of the city does not appreciably affect the rate. Out of Nelson's Loose Leaf Medicine was obtained the statement: "The belief in racial immunity (from typhoid) has been largely abandoned". However, it appears from the coefficients, that negroes as a race are more prone to die from the disease than the white race. It is unfortunate that morbidity statistics are not available which would settle the point.

From the above coefficients, we conclude that deaths from typhoid are more highly influenced by race than from illiteracy. Since the negro race is 30% illiterate in this country, it would appear that the racial differentiation is the proper construction to place on the matter. The figures show only a trend toward that condition since the correlation is not high enough to amount to a law. It may very well be that the difference is only in the mortality from the disease than in true morbidity.

Measles

Summary of correlation coefficients between death rates from measles and several factors.	
Net correlation coefficient $R_{12.34}$	$.285 \pm .030$
Net correlation coefficient $R_{14.23}$	$-.097 \pm .031$
Net correlation coefficient $R_{13.24}$	$-.001 \pm .031$
Percentage of illiteracy	$.205 \pm .030$
Population	$-.001 \pm .031$
Percentage of negroes	$-.018 \pm .031$

There is decided significant correlation between
the death rate from measles and percentage of illiteracy.
Drs. Haynes and Lawrence in Nelson's System of Medicine
point out that the mortality rate is greatest when the
family occupied but one room, is less when they dwell
in two rooms and least when three or more rooms are
occupied. Vaughan states that deaths from measles
are largely determined by the care bestowed upon the
sick and upon the extent to which secondary infection
is prevented. The observations from these two
sources indicates that the correlation found between
measles and illiteracy is but a corroboration of the
views of these sources. Probably the truth is that
a combination of the causes dependent on illiteracy
bring this about: poverty, overcrowding, ignorance.
The possibility that more children of the illiterate
contract the disease at an early age, which it is
agreed is harmful, must be thought of. Ignorance and
carelessness of life, which often accompanies illiteracy,

inadequate care of the sick, undernourishment, all
probably are factors in increasing the death rate
from measles among illiterates

Whooping cough

Summary of correlation coefficients between death rate from whooping cough and several factors.	
Net correlation coefficient $R_{12.34}$	.070 ± .031
Net correlation coefficient $R_{14.23}$	.025 ± .031
Net correlation coefficient $R_{13.24}$	-.037 ± .031
Percent of illiteracy	.083 ± .031
Population	-.035 ± .031
Percent of negroes	.050 ± .031

Holt states that in infancy, whooping cough is
one of the most fatal diseases and from that, one
would think that illiteracy would play a part in
raising the death rate as in the case of measles.
Such is not the case however nor do any of the three
factors used have any significant effect even when the
method of net correlation was used. The only thing
that can be said is that racial characteristics and
lack of education play practically no parts in
affecting favorably or adversely the death rate.

Vaughan states that high death rates from
whooping cough among negroes is not proven to his
satisfaction. He comments on the level curve of

the death rate from year to year. He suspects the
difference in death rates between blacks and whites
is due to relative lack of care given to the colored
child attacked by this disease. However, I found
no such difference in death rate between black and
white.

Diphtheria

Summary of correlation coefficients between death rate from diphtheria and several factors.	
Net correlation coefficient $R_{12.34}$	.345 ± .028
Net correlation coefficient $R_{14.23}$	-.204 ± .030
Net correlation coefficient $R_{13.24}$	.064 ± .031
Percentage of illiteracy	.295 ± .029
Population	.056 ± .031
Percentage of negroes	-.078 ± .031

Diphtheria, on the other hand, is definitely and
rather highly correlated with illiteracy especially
when population and percent of negroes are held
constant. Several factors occur to one as possibly
causing the increased mortality among illiterates:
the lack of prompt administration of antitoxin to
a case, the greater opportunities for infection
among the illiterate, the lack of resistance due to
faulty nourishment, perhaps lack of proper nursing of
the case. There seems to be a decided negative
correlation between the disease and percent of-

negroes which is interesting to speculate upon. Could
it be due to faulty diagnosis, to difference in age
distribution, to greater natural resistance to the
disease. However, on inquiry among the men in the
Departments of Immunology and Epidemiology investigating
diphtheria extensively, I learned that this negative
correlation is most probably explained by geographical
distribution since diphtheria's highest death rates are
among the Middle Atlantic States and among the states
bordering along the Great Lakes.

Diphtheria therefore is a disease the public
health official can attack with good hopes of success.
Since illiteracy is such a decided factor in raising
the death rate, it would seem that here was a splendid
opportunity for health activities to be a telling factor.

Pneumonia

Summary of correlation coefficients between death rate from pneumonia and several factors.	
Net correlation coefficient $R_{13.34}$	$.463 \pm .035$
Net correlation coefficient $R_{14.23}$	$.031 \pm .031$
Net correlation coefficient $R_{13.24}$	$-.103 \pm .031$
Percentage of illiteracy	$.491 \pm .034$
Population	$-.079 \pm .031$
Percentage of negroes	$.193 \pm .030$

Pneumonia is significantly and positively correlated
with illiteracy but the apparent positive correlation

with negroes disappears entirely when the net
correlation coefficient is formed holding illiterates
and population constant. The correlation coefficient
between illiteracy and death rate from pneumonia is
next to the highest coefficient obtained in the problem
and it is but little changed when the net correlation
coefficient is found. Vaughan lays great stress on
the racial factor in affecting the death rate from
pneumonia. He claims the negro is far more susceptible
than the white man. Osler says of pneumonia: "It is
a disease of cities, in the overcrowded districts
of which there has been an increase of late particularly
in America. ,,,,, In the United States, pneumonia is
more fatal in negroes than among the whites. ,,,,.
Individuals who are much exposed to hardship and cold
are particularly liable to the disease. Newcomers and
immigrants are stated to be less susceptible the
native individuals." Being as liberal as possible,
there is only slight positive correlation between
negroes and the death rate from pneumonia and when
formed into the net correlation coefficient the
significance disappears entirely. I would not like
to state on that evidence that pneumonia is more
fatal in negroes than among the whites since the
data in hand is exactly that which Osler implies should

be studied: that of cities especially in the United
States. He mentions New Orleans and Ancon and Colon,
Canal Zone as supporting his argument that the
fatality among negroes was greater than among whites.
Arguing from the above coefficients, could he not have
been dealing with two extremes of degree of education
in the Canal Zone which brought the difference out
markedly while the same was more or less true in
New Orleans. I believe that the difference of
death rates between the races, is due to the greater
percentage of illiteracy of the negroes rather than
to the apparent racial difference.

Pneumonia evidently is a disease which the health
officer also can attack successfully and to which
he has paid only too little attention as yet. He
must become an economist and a sociologist as well as
a health officer to accomplish this but more and more
it is appearing that the health officer must know
how to apply the principles of economics in order to
accomplish his best work.

There is almost significant negative net correlation
between population and death rate from pneumonia
holding illiteracy and negroes constant but it is not
significant enough on which to base any conclusions.

Still the trend is there and points to more
successful treatment of pneumonia in the larger
cities but does not implicate overcrowding as a
factor though here again density of population must
be included to settle the point.

Tuberculosis of the lungs

Summary of correlation coefficients between death rate from tuberculosis of the lungs and several factors.	
Net correlation correlation $R_{12.34}$	.010 ± .031
Net correlation coefficient $R_{14.23}$	.400 ± .026
Net correlation coefficient $R_{13.24}$	.094 ± .031
Percentage of illiteracy	.156 ± .031
Population	.106 ± .031
Percentage of negroes	.447 ± .026

Osler in explanation of the decreased tuberculosis
death rate lays great stress (1) on the improvement
of economic status of the world (2) the education of
the people as a whole, less drunkenness, less over-
crowding, better air, better food, the abatement of
the spitting nuisance; (3) segregation of the sick;
(4) the earlier visitation and diagnosis of cases.

But the net correlation coefficient $R_{12.34}$
between illiterates and deaths from tuberculosis,
holding population and negroes constant, is a direct
refutation of Osler's second point and, if illiteracy

and poverty are more or less synonymous, it refutes
his first point. Evidently something deeper than this
explanation is called for. Perhaps the organism has
undergone some fundamental change and lost in virulence;
perhaps the population is becoming more thoroughly
tuberculinized at a more resistant period of life
than formerly and the focus thus becoming more thor-
oughly encapsulated; perhaps it is a resultant of both
factors. At any rate, for American cities, illiteracy
plays no part in either raising or lowering the
death rate from tuberculosis.

However, there is a bare margin of $_\wedge$significance

lack of

(correlation coefficient only three times probable
error) in the net correlation coefficient $R_{13.24}$
between death rate and population holding illiteracy
and negroes constant. If density of population could
be included in this, it might concur with Osler's
statement that tuberculosis is associated with
overcrowding. However, all that can be said is that
there is some slight positive effect on the death rate
by increase in population.

The coefficient on which the eye centers is the
above table, however, is that between the death rate

and percentage of negroes. There is marked positive
correlation both in the way of the zero order and of
the second order coefficient. This bears out Daler's
statement: "It is a very fatal disease in the negroes,
particularly in the southern United States and in the
North American Indians."

Until we have much more information available,
education would appear from this angle of little
avail in this disease. Thus, whether public health
activities along this line are profitable is as yet
an open question.

Cancer

Summary of correlation coefficients between death rate from cancer and several factors.	
Net correlation coefficient $R_{12.34}$	$-.327 \pm .028$
Net correlation coefficient $R_{14.23}$	$.033 \pm .031$
Net correlation coefficient $R_{13.24}$	$.089 \pm .031$
Percentage of illiteracy	$-.536 \pm .028$
Population	$.022 \pm .031$
Percent of negroes	$-.087 \pm .031$

Cancer has been and still is an enigma as to
methods of causation and as means of spread. It
bears out the reputation in this case also. Why should
illiteracy be negatively correlated with deaths from
cancer even with population and negroes held constant?

the price of better education and consequently better
living, or is the relation merely due to faulty
diagnosis. It is difficult to explain such a relatively
high negative coefficient away because of faulty
diagnosis. The death rate from all causes is distinctly
positively correlated with illiteracy. This alone
would show that education and all that it connotes
increases the expectation of life even though we
did not have data to prove this. Might it not well
be that, since we are living longer than formerly
and since we have to die of something, and since cancer
is, relatively speaking, an older men's disease, the
death rate from it is on the increase while the death
rate from some of the infectious diseases is on the
decrease.

I had hoped that cancer would be positively
correlated with size of population of the cities
which would be an argument against the increase in

in cancer and in favor of better diagnosis of the
disease. But no such help appeared and I am forced
to the conclusion, taking into consideration only the
data at hand that with education seems to be an
associated an increase in the liability to deaths from
cancer

Diarrhoea under two years of age

Summary of correlation coefficients between death rate from diarrhoea under two and several factors.	
Net correlation coefficient $R_{12.34}$	.715 ± .015
Net correlation coefficient $R_{14.23}$	-.313 ± .028
Net correlation coefficient $R_{13.24}$	.046 ± .031
Percent of illiteracy	.679 ± .017
Population	.054 ± .031
Percent of negroes	.020 ± .031

Infant Diarrhoea is evidently another economic
and educational problem. No other of the thirty nine
correlation coefficients in the quartes is as highly
correlated, so minor approaches it in positive signifi-
cance. This correlation increases in value when negroes
and population are held constant. Seemingly, here,
the health official would do well to devote a great
deal of attention for it is here that he will most
successfully reduce death rates by means of education.

Holt says in regard to the diarrhoeal diseases:
"Diarrhoeal diseases are especially seen in cities,
for there are combined two conditions of poverty,
neglect, bad food, and bad hygiene, all of which are
important causes. That overcrowding and bad housing
is our large cities are not the chief factors is
shown by the fact that the death rate from diarrhoeal
diseases is often higher in smaller places, especially
factory towns, than large cities. Thus in New York
State it has been higher in Troy, Cohoes, and Newburgh
than in New York City; and in Massachusetts, higher in
Fall River and Lowell than in Boston." The correlation
coefficients bear out his statement excepting his
claim that often diarrhoeal diseases are higher in
smaller places for the correlation between population
of cities and diarrhoea under two is absolutely
insignificant even when illiteracy and negroes are held
constant by net correlation.

At first sight, the negative net correlation
between negroes and death rate from diarrhoea under
two holding illiteracy and population constant is
striking. But it might be explained in this wise:
e.g. holding population constant at x and illiteracy
constant at y and varying the negroes, it will be seen
that since the correlation between illiteracy and death

rate is so high, when the percent of negroes is low,
the percent of illiterates dominates the table and
vice versa which naturally would make for a negative
correlation. ~~However, Dr. Howard states that in his~~
~~experience in Baltimore, the death rate among negroes~~
~~is slightly lower than among the whites~~. At any event,
this negative correlation is interesting to think about.

Nephritis

Summary of correlation coefficients between death rate from nephritis and several factors.	
Net correlation coefficient $R_{12.34}$	$-.075 \pm .031$
Net correlation coefficient $R_{14.23}$	$.410 \pm .026$
Net correlation coefficient $R_{13.24}$	$.124 \pm .031$
Percent of illiteracy	$.089 \pm .031$
Population	$.133 \pm .031$
Percent of negroes	$.413 \pm .026$

Nephritis' correlation coefficients are most
interesting. Very evidently illiteracy plays little
or no part in such a constitutional disease as nephritis.
But on the other hand, negroes are a list of city does.
The net correlation coefficient between population and
death rate from nephritis holding illiteracy and negroes
constant is just barely significant. If the association
of life in the cities was greater than in rural areas,
this would explain it. However, I believe the explanation

lies in the misinterpretation of the causes of death on
the death certificate. I believe that it is the
custom that nephritis must be definitely diagnosed as
such else the death will be classed under heart disease.
Thus with the better hospitals and the sooner diagnosis
more usually found in the larger cities, the slight
correlation might be explained. Not so however, the
correlation coefficient between negroes and death rate
from nephritis holding illiteracy and population constant.
Osler says concerning the etiology of chronic nephritis:
"Rosenstein, Bartels, I. E. Atkinson, and Thayer have laid
special stress upon malaria as a cause. The use of
alcohol is believed to lead to this form of nephritis.
In chronic suppuration, syphilis, and tuberculosis
the diffuse parenchymatous nephritis is not uncommon."
Lues and tuberculosis and maybe malaria therefore would
explain away a part of this positive correlation, if
not the greater part.

It may be that negroes are more prone to nephritis
than the white race but so far, I can find no reference
to such a condition in the literature. If this proved
to be so, it would be most interesting. If anything,
illiteracy plays a slight negative part in the disease
which would be on the side of the negro. I believe we
are justified in concluding that the negro as a race is
not as well able constitutionally speaking to protect
himself from nephritis.

Puerperal fever

Summary of correlation coefficients between death rate from puerperal fever and several factors.	
Net correlation coefficient $R_{12.34}$	.048 ± .031
Net correlation coefficient $R_{14.23}$	.039 ± .031
Net correlation coefficient $R_{13.24}$	.038 ± .031
Percent of illiteracy	.063 ± .031
Population	.039 ± .031
Percent of negroes	.051 ± .031

The results of this series of coefficients were very surprising to me for I expected high correlation between illiteracy and death rate from puerperal fever. From the above figures, the only justifiable conclusion is that the cause of deaths from puerperal fever lies not with the patient but upon some outside influence which in this case would be the midwife, nurse, doctor. Illiteracy in the mother has the best chance to exert its full effect on the offspring whose chance of living as a result is much less than if the mother had been more educated.

Suicide

Summary of correlation coefficients between death rate from suicide and several factors.	
Net correlation coefficients $R_{12.34}$	$-.179 \pm .030$
Net correlation coefficient $R_{14.23}$	$.076 \pm .031$
Net correlation coefficient $R_{13.24}$	$.100 \pm .031$
Percent of illiteracy	$-.161 \pm .031$
Population	$.090 \pm .031$
Percent of negroes	$.018 \pm .031$

As Dr. Miner predicted, the illiterates is not so apt to commit suicide as his more educated brother. The explanation (Dr. Miner's) of this phenomenon is that the illiterate lays his trouble up against his neighbor and if any life is to be lost, it would probably be the neighbor's while the more educated man sees the matter in its true light and blames himself and so again punishes the person whom he thinks guilty. None of the other coefficients are significant. One, $R_{13.24}$, (death rate and population holding illiteracy and negroes constant), points to a harmful tendency of a larger city on a death rate, but the coefficient is not large enough on which to base any conclusions of any value.

Summary of net correlation
coefficients of ... several
diseases and illiteracy
holding population and percent
of ... constant.

Negative		Positive	
Cancer	-.337 ± .028	Diarrhoea and 2	.715 ± .015
Suicide	-.170 ± .030	Pneumonia	.465 ± .025
Nephritis	-.075 ± .031	Diphtheria	.345 ± .028
Typhoid	-.046 ± .031	All causes	.333 ± .028
		Measles	.225 ± .030
		Whooping cough	.070 ± .031
		Puerperal fever	.040 ± .031
		Tuberculosis	.010 ± .031

Summary of net correlation
coefficients between death
rates from several diseases
and negroes holding population
and illiteracy constant.

Negative		Positive	
Diarrhoea and 2	-.313 ± .028	Nephritis	.410 ± .026
Diphtheria	-.204 ± .030	Tuberculosis	.400 ± .026
Measles	-.097 ± .031	All causes	.359 ± .027
		Typhoid	.180 ± .030
		Suicide	.076 ± .031
		Cancer	.032 ± .031
		Pneumonia	.032 ± .031
		Puerperal fever	.029 ± .031
		Whooping cough	.025 ± .031

Summary of net correlation
coefficients between death
rates from several diseases
and population holding
negroes and illiteracy constant.

Negative		Positive	
Pneumonia	-.103 ± .031	Nephritis	.124 ± .031
Typhoid	-.085 ± .031	Suicide	.100 ± .031
Whooping cough	-.037 ± .031	Tuberculosis	.094 ± .031
Measles	-.001 ± .031	Diphtheria	.064 ± .031
		Diarrhoea and 2	.048 ± .031
		Puerperal fever	.036 ± .031
		Cancer	.0?? ± .031
		All causes	.016 ± .031

Table showing correlations between Population and the several death rates arranged in the order of their magnitude.			
Negative		Positive	
Pneumonia	-.079±.031	Nephritis	.133 ± .031
Typhoid	-.075±.031	Tuberculosis	.106 ± .031
Whooping Cough	-.035±.031	Suicide	.099 ± .031
Measles	-.001±.031	Diphtheria	.056 ± .031
		Puerperal fever	.039 ± .031
		All causes	.037 ± .031
		Diarrhoea under 2	.034 ± .031
		Cancer	.022 ± .031

Table showing correlations between percent of illiteracy and the several death rates arranged in the order of their magnitude.			
Negative		Positive	
Cancer	-.336 ± .028	Diarrhoea under 2	.679 ± .017
Suicide	-.161 ± .031	Pneumonia	.491 ± .024
		All causes	.438 ± .025
		Diphtheria	.295 ± .029
		Measles	.205 ± .030
		Tuberculosis	.156 ± .031
		Whooping cough	.083 ± .031
		Nephritis	.069 ± .031
		Puerperal fever	.063 ± .031
		Typhoid	.016 ± .031

Negative		Positive	
Cancer	$-.087 \pm .031$	All causes	$.465 \pm .055$
Diphtheria	$-.078 \pm .031$	Tuberculosis	$.437 \pm .026$
Measles	$-.018 \pm .031$	Bronchitis	$.413 \pm .056$
		Pneumonia	$.193 \pm .030$
		Typhoid	$.171 \pm .031$
		Whooping cough	$.060 \pm .031$
		Diarrhea under 2	$.020 \pm .031$
		Puerperal fever	$.051 \pm .031$
		Suicide	$.018 \pm .031$

On examination of the three tables of summaries
of the net correlation coefficients, one is struck
immediately by the high positions in the positive
correlation column that the infectious diseases take
in the case of correlations between illiteracy and
death rates; and, secondly, by the high positions in
the positive correlation column that the constitutional
diseases such as nephritis and tuberculosis of the
lungs take in the case of correlations between negroes
and death rates. This is most striking in the first
instance but still is fairly evident in the case of
correlations between negroes and death rates. Thus,
we could conclude that the illiterate dies before
the time of life when the constitutional diseases make
their appearance. I believe we are justified in
concluding that the negro lives longer than the
illiterate else the diseases of younger life would
be more highly correlated. Knowledge concerning the
age distribution of the population would again help
us in settling this point. Still, the facts as set
forth are indisputable evidence that illiterates die
young.

Table showing correlations worked out in the problem arranged in the order of their magnitude. (See key attached for symbols)		
Negative		**Positive**

Negative		Positive	
I-C	-.446 ± .028	I-Diarr	.679 ± .017
I-S	-.161 ± .031	I-Pneu	.491 ± .024
N-C	-.087 ± .031	N-A	.455 ± .025
P-Pneu	-.079 ± .031	I-A	.435 ± .025
N-D	-.078 ± .031	N-Tbc	.427 ± .026
P-T	-.075 ± .031	N-Neph	.413 ± .026
P-W	-.035 ± .031	I-N	.347 ± .028
N-M	-.018 ± .031	I-D	.295 ± .029
P-M	-.001 ± .031	I-M	.205 ± .030
		N-Pneu	.192 ± .030
		N-T	.171 ± .031
		I-Tbc	.156 ± .031
		P-Neph	.133 ± .031
		P-Tbc	.106 ± .031
		P-C	.099 ± .031
		I-W	.083 ± .031
		I-Neph	.080 ± .031
		I-Puer	.063 ± .031
		P-D	.056 ± .031
		N-Puer	.051 ± .031
		N-W	.050 ± .031
		P-N	.050 ± .031
		P-Puer	.039 ± .031
		P-A	.037 ± .031
		P-Diarr	.034 ± .031
		P-C	.032 ± .031
		N-Diarr	.020 ± .031
		P-I	.019 ± .031
		N-S	.018 ± .031
		I-T	.016 ± .031

In the table on the preceding page, the thirty nine coefficients have been arranged in the order of their magnitude. It is surprising how high the correlation between infant diarrhoea and illiteracy is and how very low is the correlation between negroes and infant diarrhoea while there is distinctly correlation between illiteracy and negroes. Deaths from pneumonia seem to be highly correlated with illiteracy and less so with negroes. This does not bear out Osler's statement: "In the United States, pneumonia is more fatal in negroes than among whites." As would be expected, there is high correlation between negroes and deaths from tuberculosis.

In conclusion, to sum up the results of the
problem, (1) deaths from all causes are rather highly
correlated with illiterates and with negroes, (2) typhoid
deaths are not correlated with illiteracy but are
correlated with negroes; (3) illiteracy is a factor in
raising the death rates from measles but negroes and
population are not; (4) none of the variables chosen
affect appreciably deaths from whooping cough;
(5) deaths from diphtheria are rather highly correlated
with illiterates but negatively correlated with negroes
which is probably due to low percentage of negroes in
areas of highest incidence of diphtheria; (6) illiteracy
plays a great part in raising the death rate from
pneumonia but negroes do not; (7) tuberculosis deaths
are not affected by illiterates but are decidedly
affected by negroes; (8) education raises the death
rate from cancer but negroes and population do not
affect the rate; (9) illiteracy is one of the chief,
if not the chief factor, in raising the death rate
from infantile diarrhoea while negroes and size of
population affect it not at all; (10) deaths from
nephritis are positively correlated with negroes and
just merely significantly with population while
illiteracy plays no part; (11) none of the variables
chosen affect appreciably deaths from puerperal fever;
(12) illiterates and deaths from suicide are negatively
correlated, the other two variables are significantly so.